

Reply Comments
FCC NOI 09-31
D. Maples / 20 July 2009

Thank you for the opportunity to comment on the Federal Communications Commission's Notice of Inquiry (NOI) 09-31. Because this NOI is so voluminous and asks so many questions, I have responded only in areas where I believe I may add some value. My comments are linked to the numbered paragraphs in your NOI. The Commission's questions are restated in italics.

16. ...the Commission currently uses the terms "advanced telecommunications capability," "broadband," and "high-speed Internet." Should these definitions be unified, or should they have separate meanings for different purposes, keeping in mind that current and future broadband platforms will increasingly support "high-speed Internet" as one of several offered services including voice, video, private data applications, and the like?

The Commission (and ideally the rest of the Federal government as well) should define and use a single term ("broadband access") for this purpose. The terms "advanced telecommunications capability" and "high-speed Internet" should be deleted if they overlap this definition. The term "broadband access" should be defined as access to digital communications transport that does not travel through the legacy public switched telephone network. The capability should be specified in terms of average delivered bits per second, with a maximum latency, and a probability of delivery of no less than 99%. The average should be a worst-case average calculated over all delivery conditions, and preferably over a large number of packets or frames (e.g. 1,000 or more). The measurement should exclude any header or other non-payload information.

In addition, to the extent that broadband is defined by "speed," should the Commission consider raising the speeds that define broadband?

The Commission should establish and maintain minimum average delivered bits-per-second figures in both uplink and downlink directions, with an initial minimum of no less than 2 megabits / second. While by most measures this is very slow, it is still a step up from the current definitions. This figure should represent the absolute minimum delivered to an end user. It would be desirable for the FCC to set goals based on technology that are higher than this minimum. The Commission should further establish a defined maximum figure for latency. Finally, the Commission should future-proof this definition by establishing an algorithm that adjusts this minimum level based on the rollout of new technology.

Should we distinguish among the various broadband technologies?

In rating what is and is not a "broadband access" service, the Commission should define both "wired" access (in which the end user is served by some physical connection, be it fiber, twisted-pair metallic, or coaxial metallic cables) and non-wired access (in which the end users is served by either a radio-frequency (RF) or free-space optical link) and distinguish between them. Non-wired access will almost always be slower in speed than wired access. A secondary question is whether or not the Commission should

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establish separate standards for inter-provider communications vs. communications between a provider and a customer. No position is taken on this question.

Are there specific Commission actions that could encourage more rapid adoption of these more advanced broadband deployments using mobile wireless technologies, such as Worldwide Interoperability for Microwave Access (WiMAX), Long Term Evolution (LTE), or wireline broadband deployments, such as fiber, DSL, or coaxial deployments supporting DOCSIS 3.0, for example?

There are three areas where the Commission could act:

- a. The history of wireless deployments shows clearly that without taxpayer support, universal coverage will not be achieved. Ideally, deployment of both wired and wireless broadband technologies would be supported by some sort of Universal Service Fund or equivalent, with strict accounting to ensure that monies disbursed for wireless broadband deployment in rural or otherwise underserved areas is actually used for that purpose, and that deployments occur in a timely fashion. The Commission should seek legislative help in crafting an updated Universal Service Fund or similar to facilitate this buildout.
- b. The Commission could use its authority over allocation of RF spectrum to further facilitate the deployment of advanced RF-based services for this purpose. To be effective at this, however, the Commission will first have to re-affirm its commitment to two principles:
 - a. Each spectral allocation has specific characteristics that make it more suitable for some purposes than for others (i.e. all spectral allocations are not alike)
 - b. The Commission's first responsibility as the steward of the nation's RF spectrum resources is to be an honest broker and truth-teller regarding the characteristics of each allocation and the resulting uses to which each spectral allocation can be put.

Neither of these principles are new or unusual. Adherence to these principles will simply ensure that Federal policy, as administered by the Commission, is once again aligned first and foremost with the laws of physics. The Commission seems to have yielded to pressures from various entities (including, it appears, the Congress) at times in the recent past to turn away from its honest-broker and good-steward roles to one that primarily champions immediate or short-term economic returns. This is bad for both the Commission and the country.

Assuming the Commission is willing to reassume its role as the good steward and honest broker, it should lead the nation to do the same by conducting a **real** audit of what existing licenses are **actually in use**, vs what is on file. With this

information in hand, the Commission should then examine assignments for each spectrum allocation in the most-effective mobile bands (e.g. 30 MHz to 6 GHz) and determine whether or not band rearrangement in one allocation or another might create more “white space” for deployment of broadband applications by existing or newly-defined services. The Commission should also understand the propagation / multipath / fading characteristics of each allocation in all different population venues (i.e. dense urban, suburban, rural, mountainous, plains areas, coastal areas, etc.) to determine what might be done with advanced modulation techniques to obtain reliable higher-bandwidth transmission from relatively limited spectrum resources. It is highly likely that rebanding of existing allocations and assignments could result in not only a number of new broadband allocations that are well-suited for rural use due to exceptional propagation characteristics but also in better utilization of the spectrum resource for both narrowband and broadband traffic, including not only private-sector but public-sector (e.g. public-safety) applications. This will almost certainly result in additional unplanned economic activity, as industry takes full advantage of new opportunities to design and deploy hardware to satisfy needs for voice and data transport. The Commission should partner with NTIA in this endeavor to ensure that spectrum allocations for both Federal and non-Federal activity take full advantage of the highly-flexible nature of today’s RF platforms while ensuring that legacy licensed devices receive adequate protection from interference throughout their service life.

- c. The largest single stumbling block to transition to broadband networking is the enormous installed physical plant of twisted-pair copper telephone cables. Transitioning this to passive optical plant would allow the deployment of broadband connectivity, both wired and wireless, throughout the country. Ideally, the passive optical plant would extend to customer premises, with a solar-powered interface at the premise. This is obviously an enormous undertaking spanning a number of years (in all probability one to two decades), and the use of taxpayer monies in this situation will require strict auditing; however, the copper plant represents an enormous millstone around the necks of small telephone operators, particularly in rural areas. It is unclear how these operators can possibly make this transition, or even survive over the long term, without assistance (as was the case when rural America was first wired for switched telephone service). The Commission should again be the “honest broker and truth-teller” in this area, while providing the Congress a real plan to move through this transition. Obviously the Congress will ultimately determine to what extent this occurs.

17. We also seek comment on whether a definition of “broadband” should be tethered to a numerical definition or, instead, an “experiential” metric based on the consumer’s ability to access sufficiently robust data for certain identifiable broadband services. In this regard, should we define broadband in terms of bandwidth and latency, capability

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to download a certain type of media in a certain amount of time, ability to access a certain online service or operate a certain application without depreciation in quality, or by some other metric?

It is unclear how a consistent, measurable experiential metric could be devised. As noted in 16, a strict measurement of average delivered bits per second, with a figure for latency and for probability of successful delivery is the correct metric.

Furthermore, should such performance metrics apply only for the local access link, for the end-to-end path, or some other portion of the network? To what extent should our consideration of access to broadband capability take account of the middle mile? Much of the focus on broadband deployment has been on last mile connections. Is there a need, for instance in rural areas, for a greater focus on broadband capabilities in the network beyond last-mile connections? How robust are broadband capabilities in backbone and feeder networks throughout the country?

With regard to where focus should be placed (e.g. last mile, middle mile, etc.) the goal is to provide broadband to end users, regardless of their location. All phases of that provision (last mile, middle mile, etc.) should be balanced as required to provide some level of end-to-end performance.

It can be envisioned that some individuals will live far enough away from an established broadband corridor that it is not economical to provide them service. The Commission should include in its rules (a) a mechanism (including both technical and operational standards) for a broadband provider to hand off service to a privately-owned circuit provided by an end user, (b) a requirement for sharing of remote measurements from the far end of both the private circuit and the provider's circuit (to eliminate finger-pointing about performance or malfunction), and (c) necessary rules to govern the provision of such privately-owned "tail circuits" for this purpose.

18. We also request comment on whether a definition of broadband should be static or dynamic, with speed tiers that adjust with changes in technology. Further, we seek comment on the definitions for broadband used by other government agencies and how any such definition by the Commission would impact the various government programs designed to improve consumers' access to or use of broadband services. For example, should the Commission define broadband in the same manner as other agencies charged with implementing parts of the Recovery Act?

The definition of broadband will be slowly dynamic by its nature. The Commission's definition should include a mechanism to adjust the definition based on average delivered speeds to the country as a whole. It should not take an act of the Commission or the Congress for the definition to change.

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The definition of broadband should be standardized across the Federal government. It is unacceptable for different agencies to define this differently. Broadband is broadband.

19. Should a different set of standards be used to identify mobile broadband services – which allow mobility or portability but may have lower throughputs – and fixed broadband services?

Different standards for average delivered bits/second should be applied to over-the-air and wired broadband delivery, subject to the absolute minimums in (16) for average delivered bits/second, latency, and probability of delivery. Over-the-air delivery will always be slower.

Should the definitions vary depending on whether the broadband service is used to serve residential or business customers and if so, how? Should rural regions, with their inherently higher deployment costs, have different definitions or standards for broadband than urban areas?

Definitions for business and residential customers, or for rural vs. urban areas should not be different; broadband is broadband. This does not mean that the costs for business and residential subscribers cannot be different. Business subscribers in the days of regulated telephone monopolies paid higher rates to subsidize residential telephone service; such a practice might or might not be useful again.

How should satellite technology with comparatively limited bandwidth and higher latency but potentially lower cost of deployment in rural regions be accounted for?

No comment on this question.

Should our definition include some baseline dependability metric?

As noted in (16), a baseline probability of delivery per end user should be part of the definition. This probability of delivery addresses both issues with shared media and issues surrounding weather and other disruptions.

Are there other dependability concerns, such as susceptibility to weather disruptions, that need to be addressed now or in the future?

Rain fade will be a significant factor in satellite broadband. Additionally, weather-related phenomena in some spectral allocations is likely to make external directional antennas attractive. To properly deal with external antennas, the Commission should (a) ensure that homeowner's association restrictions on satellite antennas larger than 1 meter and antennas associated with RF-based broadband delivery are thoroughly exempted from homeowner-association or other restrictive covenants, (b) require that all external antennas so exempted be properly installed (including grounding and surge

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protection per the electrical code of the local jurisdiction (usually NFPA 70 as adopted), and (c) require that all external antennas so exempted be properly maintained (e.g. no rusty hardware, missing elements, etc.) and allow but do not require homeowners associations and local jurisdictions to take action to require homeowners who use external antennas that are so exempted to maintain those antennas.

20. In shared bandwidth broadband access technologies, how should actual speed delivered to consumers be determined, taking into account that for wireline systems, frequency bandwidth, the number of simultaneous users, and distance to the end user affect the data rates delivered? In addition to the bandwidth and number of simultaneous users, the data rates delivered to wireless end users depend upon, among other factors, transmitter power, frequency re-use, and the distance between the end user and the base station. More specifically for actual speeds on a wireless network, should they be determined at the edge of the service contour, and if so, what service contour level would define the edge of service? To what extent should the number of simultaneous users be considered when defining the individual end user data rates since the network capacity may be shared with many other users at the local level? In general, how should the speeds and other characteristics of services delivered to consumers be determined?

Speed should be defined as in (16). No special considerations should be adopted for shared infrastructure (e.g. cable systems or cellular systems); the probability of delivery figure addresses shared infrastructure. For cellular systems, the measurement location should be the edge of the handover contour for the cell site in question.

21. We invite comment as to the state of deployment of broadband services that are offered under our rules for unlicensed devices.

The Commission opens this section by noting that broadband services are provided under its provisions for operation of unlicensed radio transmitters, citing (a) WiFi as an example,. The Commission also notes that it has established provisions for unlicensed devices to operate in the TV white spaces, and has established rules for Broadband over Power Lines (BPL). The Commission invites comments on the state of deployment of broadband services offered under rules for unlicensed devices.

There is no question that WiFi is one of many success stories for the Commission. The Commission should look carefully at the Wi-Fi decision and use the underlying technical and economic considerations as their model for further decisions regarding use of spectrum to satisfy broadband or other desires. In the case of WiFi, the spectrum chosen (2.4 and 5.8 GHz) had two principle characteristics (poor RF propagation and no significant noise-limited incumbents) that matched the economic model chosen (unlicensed operation). The poor propagation of WiFi meant that many of the concerns for frequency reuse and mobility management simply become non-issues. This in turn significantly lowered the cost of the equipment. Additionally, the

lack of incumbents attempting to operate their RF links at or near the receiver noise floors (i.e. noise-limited operation) means that WiFi equipment needed for the most part to deal only with other WiFi transceivers in the area. The poor propagation meant that few WiFi systems were seen by the average WiFi receiver, and those that were seen were likely to be affiliated with the same RF network. This allowed a very simple sense-and-avoid mechanism (to the extent that any was implemented at all) to suffice to manage the WiFi devices. By every measure the WiFi economics and technology were and are a very close match. In short, **this decision is a good example of the Commission correctly identifying what a given spectral allocation is good for and creating sensible rules for its implementation.**

By contrast, neither the White Space Decision nor the Broadband over Power Lines decision represents the same quality of engineering on the part of the Commission. In both cases the Commission has failed to properly recognize what the spectrum allocation in question is good for and devise sensible rules for its use.

1. The Commission should revisit its decision to release the TV White Spaces for unlicensed devices. The spectrum in question is not as well suited for unlicensed "super Wi-Fi" devices as it is for licensed deployments, for two reasons:
 - a. The UHF TV band propagates well. This causes frequency-reuse and capacity issues to become significant. By comparison, the original Wi-Fi bands (2.4 and 5.8 GHz) propagate so poorly that frequency-reuse and mobility-management concerns are essentially nonexistent, as was noted above.
 - b. The UHF TV band has incumbent users operating noise-limited systems (i.e. over-the-air (OTA) TV receivers). By comparison, the original Wi-Fi bands do not have incumbent users attempting to operate near the receiver noise floor, as was noted above.

The Commission has included in its rules for the TV White Space devices mechanisms for database lookup or spectrum sensing to attempt to avoid interference to the OTA TV receivers; however, at least one interference mechanism (intermodulation products generated in the TV receiver itself by the presence of multiple locally-strong White Space devices) is not addressed by either mechanism. This will invariably lead to interference complaints, as happened in the 800 MHz public safety band. It can be argued (and undoubtedly will be argued by others) that since this unlicensed service will cause interference to a licensed service, it should not be allowed to operate as an unlicensed service. Even if that is argued past, however, unlike in the 800 MHz range, the interference to licensed users will not be easily located or mitigated. The manufacturers of the unlicensed hardware have no

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mechanism to detect intermodulation interference in their hardware. The users of the unlicensed hardware have neither the obligation nor (in most cases) the technical skill to detect such interference or cope with it. **The TV viewer will be essentially without recourse.**

The Commission should rescind the decision for unlicensed operation in the TV white space, and should use that space for rural broadband deployments by licensed entities. It should structure those licenses so that they must be built out and maintained providing real services to real customers (not just put up transmitters that identify from time to time to hold the licenses). The licenses should not be auctioned, but should instead be leased annually. The licensees should be required to ensure that they will not cause intermodulation interference to OTA TV receivers by choice of frequencies used, etc.

2. The Commission should revisit its rules for Broadband over Power Lines (BPL). These rules represent a second example where the Commission did not properly choose spectrum for a desired system based on its propagation characteristics and presence of incumbent users. In the BPL action, the Commission further acted with lack of integrity by withholding information that was contradictory to its desired findings. The Federal court system has already found against the Commission for its behavior on the BPL issue. Such conduct is reprehensible, and casts doubt on future Commission actions as properly representing the interests of the United States. The Commission must recommit itself to being an honest broker on this and every issue that comes before it, as was noted in (16).

The original spectrum chosen for BPL operation (2-80 MHz) is occupied by numerous incumbent users who are all operating systems against receiver internal noise. Additionally, the 2-30 MHz spectrum represents a unique natural resource, because unlike any other portion of the radio spectrum it can be used for global communications without intervening infrastructure. Countries around the world depend on it for such communications today. It is not known to what extent BPL operations would have resulted in interference to global communications if BPL systems had been built out as the Commission expected, but if such interference had occurred, the Commission could have found itself the target of complaints from governments around the world. Over and above that, however, deliberate pollution of a natural resource is something that the Federal government normally establishes rules to avoid; in this case, however, the Commission acted with deliberation to pollute this unique spectrum, and then withheld information that tended to undercut the Commission's position in the issue.

The Commission's interest in BPL is not without merit. BPL can, under controlled circumstances, provide a measure of broadband connectivity in

locations where it is not economical to provide it any other way. In order to do so, however, while avoiding spectral pollution, **the Commission should treat BPL as what it is—an intentional radiator of RF energy—and establish a primary spectral allocation for it to operate in that takes into account the propagation characteristics of the spectrum and the presence of incumbent users.** One possibility might be the 54-88 MHz spectrum currently used by TV broadcasting. After the demise of analog TV broadcasting in the US, it is unclear that there will continue to be many US TV stations still in that spectrum, and seemingly little interest in that spectrum for other services. A BPL offering in that spectrum might make relatively good use of the spectrum, even if the small number of remaining TV stations in the band had to be paid to vacate. Further, by establishing a defined spectrum allocation for BPL to operate in that did not contain large numbers of incumbents, BPL vendors could develop their hardware with relatively strong assurance that they would be able to sell and operate the hardware freely without having to worry about interference. Finally, were the Commission to work through the ITU to establish such an allocation worldwide, BPL equipment vendors might well expand their market to the entire globe while continuing to enjoy protection from interference claims.

Should they be considered as a means of providing broadband service, particularly where no other service exists? If so, how should that service be defined or quantified since unlicensed devices are not necessarily associated with specific areas of operation? We note that unlicensed devices operate on a non-interference basis and must share spectrum with all other such devices. Accordingly, a particular quality of service or data speed often cannot be assured. Should we treat data speeds and metrics for unlicensed devices and services differently because the sharing scenarios and their impact on reliability and data speeds are difficult to predict?

It is difficult to reconcile possible expenditure of Federal funds with the use of unlicensed services, since service guarantees to end users will be almost impossible to maintain. Under those circumstances, expenditure of Federal funds appears to be misappropriation. For this reason, large-scale use of unlicensed services for broadband provision appears to be unjustified. As noted in (17), however, there will be cases where private “tail circuits” will be required to extend broadband connectivity to individual locations. Use of unlicensed equipment in those applications appears to make very good sense, as long as suitable rules are established for such applications (e.g. use of directional antennas, etc.)

23. *We seek comment on what it means to have access to broadband capability.*

A simple definition is that service is available and can be subscribed to in one’s place of residence, as is the case with other utilities.

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24. *We seek comment on whether (and if so, how) the Commission should evaluate the term “access” with certain basic consumer expectations in mind. In 2005 the Commission adopted an Internet Policy Statement in which it committed “to preserve and promote the vibrant and open character of the Internet as the telecommunications marketplace enters the broadband age” by incorporating four consumer-based principles into its ongoing policymaking activities. We seek comment on whether, in developing a national broadband plan, we should consider applying these principles more broadly in light of the evolving ways providers store, distribute, and otherwise provide service via broadband access facilities, particularly in ways that are not carried over the Internet. We ask if these principles require elaboration or explanation in light of the telecommunications environment that has evolved since their adoption, and whether the Commission should turn the principles into rules through a rulemaking.*

The four principles enunciated in the 2005 Policy Statement were (1) “consumers are entitled to access the lawful Internet content of their choice”; (2) “consumers are entitled to run applications and use services of their choice, subject to the needs of law enforcement”; (3) “consumers are entitled to connect their choice of legal devices that do not harm the network”; and (4) “consumers are entitled to competition among network providers, application and service providers, and content providers.” These principles still hold true, with one possible exception: If Federal funds are going to be used to extend broadband services, it does not make sense in the current or projected Federal debt environment for multiple carriers to be funded by the taxpayers to overbuild service to the same geographic area. For those areas where normal return on investment is insufficient to trigger a buildout, it will be better for the taxpayers to operate those areas as regulated monopolies, and strictly divorce content provision from transport in those areas. The United States has done this before with residential telephone service; there is no reason not to use such a model again so long as content is strictly divorced from transport (as it was then).

As far as making the principles rules is concerned, the Commission should point to the underlying principles behind the First Amendment of the Constitution (the right to speak freely) and make rules that capture the following principles:

- a. No transport provider may discriminate against traffic based on the content, origination point, or destination point of that traffic, either through denial of connectivity or by preferential treatment of one traffic type over another, except to address 911 or national security / emergency preparedness needs (see 72 for more details).
- b. Transport providers may charge different rates for different bandwidth requirements, but are required to charge the same rates for the same bandwidth requirement, regardless of source, destination, or traffic content
- c. No transport provider shall be liable for the content of traffic delivered over his network

- d. The content originator is always liable for the content of traffic originated over the network, subject to First Amendment considerations
- e. Transport providers shall implement standard methods to prioritize certain types of traffic related to national security / emergency preparedness (NS/EP) and 911 call handling (in order to mimic Government Emergency Telecommunications Service / Wireless Priority Service (GETS/ WPS) traffic handling in the national broadband network) and to ensure that 911 traffic receives priority handling.

These rules would (a) allow transport providers to recoup the costs of providing transport while prohibiting them from constructing “walled gardens” for their subscribers, (b) ensure that transport providers did not have to fear lawsuits from traffic that someone found objectionable, and (c) ensure that 911 calls or other NS/EP traffic handled using VoIP will receive proper prioritization in the broadband network. This last item, while not a First Amendment issue, is important because there currently is no such prioritization functionality in the broadband network (QoS is NOT the same as prioritization); current VoIP subscribers may or may not receive preferential treatment of packets in a 911 call, particularly if their VoIP service is not provided by their transport provider.

25. To what extent should the Commission consider price or marketplace competition for broadband as it considers whether people have access to broadband capability? For example, how should the Commission consider the benefits of consumers in a particular area having only a single provider, using one type of technology, versus the competitive benefits that could result from having one or more providers using similar or different technologies? How should the national broadband plan establish priorities for unserved areas versus areas with limited competition and capability?

The first goal should be to get broadband service in place to US citizens. This is almost certainly going to involve some form of regulated-monopoly structure for those areas that are currently unserved, since the normal marketplace has not, after sufficient opportunity, done the job. Priority should go to unserved areas first, with due consideration for regulation of those areas with only a single provider.

28. We seek comment on what it means for a person with disabilities to “have access” to broadband capabilities.

This is a valid but unrelated discussion. The Commission’s plan should focus on transport, rather than content or endpoints. It is appropriate, however, for the Commission to (possibly with Health and Human Services) investigate how broadband endpoints should be designed and made available to disabled persons.

30. *We seek comment on the interrelationship between the various reporting obligations the Commission is tasked with under the BDIA and the NTIA and RUS grant projects. How well do these varied reporting obligations mesh and what revisions might be appropriate?*

To the extent that the Commission is burdened with multiple reporting requirements, the Commission should request from Congress a legislative change to require a single set of reports.

32. *We recognize that accurate and comprehensive data plays a critical role in assuring the success of a national broadband plan. As such, we seek comment on how we can ensure that any and all data collected in furtherance of developing and implementing a national broadband plan can be as accurate as possible. We also seek comment on what types of necessary public and private sector data are not being collected, how we can obtain such data, and how we should use such data in furtherance of a national broadband plan. Further, we ask how the Commission should balance legitimate confidentiality interests in the data it collects against goals of accountability and openness, as well as allowing the public to measure and review progress.*

This might seem to some like a minor issue, but it most definitely is not. Corporations jealously guard their business information, and with good reason. Obviously, all data must be secured under non-disclosure agreements (NDAs). The Commission may have to seek legislative assistance in ensuring that it can collect the data it needs to measure progress. It may also be useful for the Commission to establish “standard” NDAs for this data.

With regard to the data itself, it would be useful for the Commission to specify standard XML-based schemas for the data to be exchanged in. This would allow the Commission to process data from multiple entities quickly, and would allow more effective “mining” of that data to answer currently-unanticipated questions.

38. *In order to capably develop a national broadband plan, how useful or necessary is it for the Commission to understand the costs of deploying broadband networks to the unserved and underserved areas of our country? Should the national broadband plan seek to bring broadband to 100 percent of the country? If so, what are the costs and benefits of bringing broadband to the least densely populated areas?*

The Commission must as a part of their plan development clearly understand the costs to bring broadband access to the population.

Should the national broadband plan seek to bring broadband to 100 percent of the country? If so, what are the costs and benefits of bringing broadband to the least densely populated areas?

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The broadband plan should indeed be designed to bring broadband to 100% of the population, whether or not there are some geographic areas that are unserved. The reason for this is that we are one nation of citizens, not several groups of consumers. We should be seeking to treat our population as one population. This is a philosophical position, not an economic one; however, I still believe it valid.

39. We seek comment on the impact of broadband on our existing universal service programs...

Briefly, the nation's telecommunications industry is migrating from circuit-based switched transport to packet-based transport; however, the underlying principles which led to the creation of all of the universal service programs focused on providing services to citizens. The fact that the transport method is changing does not undercut those principles. The Commission should review the existing universal service programs with an eye toward how they serve the citizenry, and then plan adjustments to those programs to facilitate the transition to the use of broadband transport. The Commission must not allow either the telecommunications industry or others to use the transition to different types of transport as an excuse to undercut or starve the universal service programs. Again, this is a philosophical position; however, it is based in the idea that we are one nation of citizens, not multiple groups of consumers.

44. We seek comment on the extent to which access to spectrum may pose a constraint on broadband access and development. We also seek suggestions for approaches toward spectrum allocation, assignment, management, and use that will best promote national access to broadband service.

Access to spectrum, particularly allocations that are broad enough to support high-bandwidth services, is an ongoing challenge. This is exacerbated by (a) spectrum hoarding as a result of auction processes, (b) spectrum hoarding through license renewal processes, and (c) in some allocations, assignment plans that do not reflect the current capabilities of technology.

With regard to spectrum hoarding, it is unclear why spectrum is not leased on an annual basis rather than being auctioned or licensed without fees. Annual leasing provides a fixed period of use of the spectrum, and assesses a recurring price for doing so. Managing spectrum through annual leases with fees guarantees that (a) spectrum will not be hoarded or mismanaged and (b) the Federal government will continue to receive revenue for the spectrum. Ideally, leasing would apply to all spectrum users, even those who up to now have enjoyed spectrum "for free".

Nobody enjoys paying for things, but with Federal debt at unprecedented levels, mechanisms to more thoroughly "spread the pain" of raising revenue need to be sought. This would be another mechanism for raising revenue.

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With regard to assignment plans, it may be worthwhile to examine how, for example, the land-mobile bands have been allocated and assigned. It is possible that a rearrangement of assignments in those bands may actually free up channels for additional users.

Should the Commission conduct a “spectrum census” or “spectrum inventory” to identify spectrum bands that may be suitable for wireless broadband services?

As noted in (16), the Commission should do this.

The overriding principle in deciding which portions of the spectrum would be most appropriate is the propagation characteristics of the spectrum and the type and nature of incumbents in the spectrum. As noted in (16), **the Commission must be the citizenry’s honest broker of which types of services best fit which spectral allocations, and why**. As an example, some spectral allocations may be suitable not only for mobile services but also for flight-safety or national-defense radars, and may have such radars as incumbents. Should the Commission even entertain the notion of collocating mobile services with the radars, or of moving the radars to other (possibly less effective) spectrum? Obviously not; however, the “all spectrum is alike” or “we can all coexist together cognitively” position advocated by some in industry would not lead to the proper conclusion here.

If so, which portions of the spectrum would be most appropriate for examination?

The Commission should start its survey with existing mobile service bands currently in use, followed by existing mobile service bands that are not yet in use, before considering other spectrum allocations.

There are a variety of ways in which the Commission might conduct a “spectrum census” or “spectrum inventory”, including review of spectrum allocations, licenses, spectrum monitoring, and user surveys. What approaches would be most effective in assessing the actual use of existing spectrum and gauging potential opportunities for wireless broadband services?

This questions divides into two parts, based on whether the allocation is an existing mobile services allocation or not.

For existing mobile service allocations, allocation review will begin the process. Aeronautical mobile services, for example, may be directly related to flight safety and would therefore not be good candidates for sharing with broadband services. Land-mobile allocations, on the other hand, might be conducive to sharing in at least some fashion. Existing commercial mobile allocations, of course, are immediate candidates, particularly if they have not yet been built out.

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Following allocation review, those mobile allocations that are candidates should be reviewed using a combination of unannounced spectrum sensing compared with license review, followed by user surveys to analyze discrepancies in the spectrum-sensing and license review outputs. This combination should reveal licenses that are issued against systems that are no longer operating, systems operating without a license, and systems that are operating only for spectrum protection as opposed to carrying actual traffic. The user surveys will also indicate if a system is rightly an occasional-use system. The user surveys should definitely capture the type of equipment being used.

At the end of the analysis, the Commission should (a) cancel licenses for systems that no longer exist, (b) address unlicensed systems per existing rules, and (c) cancel licenses for systems operating only for spectrum protection if it is legal to do so. Additionally, for the land-mobile bands in particular, the Commission should also analyze the potential for the bands to be rearchitected to allow for standard repeater offsets. Implementation of standard repeater offsets in these allocations will set the stage for complete protection of incumbent systems by cognitive radios attempting to use spectrum sensing for locating unoccupied spectrum. Rearchitecting these bands may also make it possible to create some wider-band half-duplex or full-duplex channels to facilitate higher-speed data transport. Both of these ideas might be of particular interest in the 150-162 MHz allocation. NTIA might make use of similar techniques in the allocations surrounding the 150-162 MHz allocation.

For allocations that are not existing mobile services allocations, the Commission's role as the honest broker becomes even more critical. These allocations cover a multitude of services essential to the safety and operation of the nation, and whose usage patterns have absolutely no relationship to the kinds of usage demonstrated in the commercial mobile service bands. The Commission should partner with NTIA to resist current and projected pressures from Congress or industry to abdicate their role as the honest broker here. The same general principles used for existing mobile service bands apply; however, the Commission should spend much more time at the allocation level.

How should we measure "use" of spectrum, accounting for different technical properties, licensing framework, and the like, in determining whether spectrum is being fully utilized?

Spectrum "use" has first to do with the mission of the systems using the spectrum, and the value of that mission to the nation as one group of citizens, not multiple groups of consumers. For example, air-defense radars and the communications systems that support them may only operate occasionally, yet their overriding value to the nation is unquestionable. The same is true of flight-safety systems, aeronautical mobile communications related to flight safety, and other applications. The value of these systems to the nation cannot be estimated as a simple cost-benefit or profit-loss issue, but it is no less real.

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The Commission must seek help from the affected end users in setting a “value” on the use of spectrum in these applications, and must be prepared to with those end users defend these value judgements to the Congress.

In conducting such a census or inventory, how should “underutilized spectrum” be defined and what actions should be taken if the spectrum is underutilized?

As noted above, the value to the nation is the overriding priority, even if it cannot be expressed in dollars and cents.

Would such a census or inventory, especially if conducted along with a similar census or inventory by the National Telecommunications and Information Administration of Federal Government spectrum use, be helpful in implementing a more efficient use of spectrum or locating spectrum used for other purposes that could be reallocated and made available to meet growing demand for broadband communications and data services?

This can only be effective if the value judgements referred to earlier are made. It is increasingly unlikely that those value judgements will indicate that it is useful to reallocate more spectrum to mobile services. Considering that most existing commercial mobile spectrum is NOT built out in rural areas, it is useless to set aside more of it to remain unbuilt in those areas. Additionally, there is no evidence of lack of competition in the existing metro areas

More broadly, in developing a national broadband plan, we seek comment on how the Commission’s joint spectrum policy responsibilities with NTIA should inform this plan.

The Commission and NTIA should jointly assess the value judgements of non-mobile allocations to the nation, and as noted earlier be prepared to resist Congressional pressure to be anything other than rigorously honest brokers in this arena.

To what extent can new technologies such as cognitive radio enable more efficient use of existing spectrum allocations or create new opportunities for sharing spectrum with existing services?

Cognitive radio can potentially add significant benefit; however, this technology is still essentially in its infancy. The methodologies to protect incumbents, particularly those operating repeaters with non-standard offsets, are not well-developed. Additionally, there are issues with protecting incumbent noise-limited receivers, as noted earlier. Until these issues are thoroughly dealt with, the indiscriminate use of cognitive radio will most likely lead to intractable interference problems for incumbent users.

45. The Commission has recently adopted the White Spaces Order, which opens up the use of significant spectrum in the core TV spectrum bands for use by unlicensed devices. Many see these rules as creating an important new mechanism that can help ensure broadband services become available for more Americans. Given the

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importance to wireless broadband services of backhaul to the PSTN and the Internet, how can this spectrum be maximized to provide point-to-point backhaul in rural areas?

As was noted in (21) use of the White Space spectrum for unlicensed devices is not a good overall use of the spectrum involved. The Commission should rescind this order and reallocate at least most of this spectrum for licensed services.

Assuming this is reallocated to licensed services, maximizing its utility for point-to-point services will require mandatory implementation of (a) bidirectional power control between the ends of each RF link and (b) directional antennas.

Several other bands are currently used by WISPs to provide broadband through the use of unlicensed devices. What more should the Commission do with respect to permitting the use of unlicensed devices?

This segment of the industry is now mature enough to begin following better engineering practices with regard to spectrum management, specifically use of power control and directional antennas. This is even more critical in outdoor areas.

Additionally, as the Commission relies more and more on unlicensed operation, additional attention must be paid to this transition, particularly with regard to protection of legacy licensed services.

How should the Commission measure "subscriberhip" or use of devices utilizing unlicensed spectrum?

Since unlicensed devices cannot provide any legal measure of service reliability (since they must accept interference from licensed services) it is difficult to assign rigorous service quality figures to those subscribers at the end of unlicensed connections. It is even more difficult to justify expenditure of Federal monies on such equipment precisely because no legal measure of service reliability can be created. Given these conditions, it is hard to justify including subscribers served by unlicensed devices in the national broadband plan.

What more should the Commission do to promote the development of cognitive radio devices in order to ensure more availability of spectrum for broadband uses?

The Commission's main role here is to be an honest broker regarding (a) the potential for cognitive radio devices to interfere with legacy services and users and (b) managing a real transition plan from the current regime to one in which cognitive radio plays a growing part of the overall use of spectrum. It is inappropriate for the Commission to cheerlead this or any other technology without taking a firm lead on providing rigorous, peer-reviewed analysis of all potential downsides to deployment.

To what extent should unlicensed wireless play a role in a national broadband plan?

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As noted above, since unlicensed devices cannot provide any legal measure of service reliability (since they must accept interference from licensed services) it is difficult to assign rigorous service quality figures to those subscribers at the end of unlicensed connections. It is even more difficult to justify expenditure of Federal monies on such equipment precisely because no legal measure of service reliability can be created. Given these conditions, it is hard to justify including unlicensed wireless as a principle part of the national broadband plan.

46. The Commission has fostered opportunities for new satellite services capable of delivering broadband from satellite-based platforms. In implementing the Broadcasting-Satellite Service in the 17/24 GHz band, the Commission has created the potential for a new generation of broadband services to the public, providing a mix of local and domestic video, audio, data, video-on-demand and multi-media services to U.S. consumers. Satellite operators have also been authorized to maximize spectrum utilization through the provision of ancillary terrestrial component services, including wireless broadband. Moreover, the Commission continues to license satellite-based broadband services for consumers in aeronautical, land-mobile and maritime environments. The Commission has also streamlined non-routine earth station processing rules, which has facilitated access to terrestrial communications facilities by satellite-based broadband service providers. Given the ubiquitous coverage capabilities of satellites, we seek comment on what further actions the Commission can take to promote the use of satellite-based platforms for access to broadband, especially in rural and remote communities.

As noted in (19), rain fade will continue to be an issue for satellite-based services, particularly in the 17/24 GHz spectrum. To deal with this, the Commission should (a) ensure that homeowner's association restrictions on satellite antennas larger than 1 meter and antennas associated with RF-based broadband delivery are thoroughly exempted from homeowner-association or other restrictive covenants, (b) require that all external antennas so exempted be properly installed (including grounding and surge protection per the electrical code of the local jurisdiction (usually NFPA 70 as adopted), and (c) require that all external antennas so exempted be properly maintained (e.g. no rusty hardware, missing elements, etc.) and allow but do not require homeowners associations and local jurisdictions to take action to require homeowners who use external antennas that are so exempted to properly maintain those antennas.

49. We seek comment on the extent to which competition between various broadband network providers, application and service providers, and content providers should be evaluated as an effective and efficient mechanism to achieve the goals of the Recovery Act.⁷² We seek comment on whether multiple providers of broadband services are useful or necessary for achieving our goal of providing broadband services to unserved and underserved areas.

Multiple providers will have to build "on top of each other" to provide broadband access to the same area. If Federal funds are used to do this (as will almost certainly be

necessary, given the failure of market forces to make funds available), having multiple providers, at least initially, is counterproductive. If the goal is to provide service, it appears far wiser to take the same Federal fund package, establish regulated monopolies to start with, and cover more subscribers. The regulated monopolies, of course, will have to have service metrics to meet. We have done this as a nation before; there is no reason not to do it again, particularly with Federal debt at the level it is.

While competition between multiple providers may lower prices and provide a greater diversity of services, how does subsidizing more than one provider in areas with low population density affect the ability of the providers to achieve optimal economies of scale and to continue to operate effectively?

As noted above, it is counterproductive.

Does it make a difference if the providers utilize different technological broadband platforms? How should we evaluate the potentially increased costs of supporting multiple providers relative to any benefits to consumer welfare from competition?

If Federal funds are used, this will guarantee a higher cost to the taxpayers per customer served. This is counterproductive; the nation cannot afford this luxury.

72. In the development of a national broadband plan, the Recovery Act requires that the Commission include “a plan for the use of broadband infrastructure and services in advancing . . . public safety and homeland security.” We seek comment on how to interpret and implement this directive, including an analysis of existing policies and programs that are on point.

Transport providers should be required to implement standard methods to prioritize on a per-packet basis certain types of traffic related to national security / emergency preparedness (NS/EP) and 911 call handling. This must be done in order to (a) transition Government Emergency Telecommunications Service / Wireless Priority Service (GETS/ WPS) traffic handling from the current PSTN to the national broadband network, and (b) to ensure that 911 traffic on the national broadband network receives priority handling.

Current QoS methods do not provide mechanisms for multiple levels of priority and thus do not ensure that either NS/EP traffic or 911 traffic from the general public is prioritized on a per-packet basis relative to “normal” traffic.

The goal from an NS/EP standpoint should be to provide a thoroughly-resilient network composed of standards-based hardware available from multiple manufacturers that can be repaired and maintained by modestly-trained personnel even after catastrophic damage, and which can provide multi-level prioritized NS/EP traffic from any connection point during both normal periods and periods of stress without pre-coordination, special

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circuit engineering, or other potentially-unsupportable impediments. The FCC has already done an admirable job in leading the industry to implement multi-level prioritization through the GETS and WPS programs; doing similar good work for the national broadband network will add enormous value to the network while reducing the need for construction of “special” networks for public safety or NS/EP applications.

We seek comment on how to identify which broadband services are most needed to advance public safety and homeland security. For example, should the Commission focus on broadband high-speed Internet connectivity for public safety and homeland security needs? How should the broadband infrastructure be designed in order to support both the needs of the public for connectivity to the global Internet and the needs of emergency services for connectivity to a restricted, private IP infrastructure?

If the Commission focuses on ensuring that the national broadband plan includes standards for ensuring that the national broadband infrastructure provides prioritized, resilient transport for NS/EP applications as an inherent part of the design (i.e. not just an add-on at specific locations), public safety and homeland security forces will put the resultant national broadband infrastructure to use for applications which cannot even be foreseen at this time. Rather than concentrating on specific services, **focus on the transport.**

We also seek comment on how access to broadband capability may promote interoperable wireless-based communications among various public safety agencies and jurisdictions, as well as plans and benchmarks to improve interoperability.

Prioritized, resilient transport, if combined with defined, open Federal standards for interfacing to existing and planned RF communications systems in such a way to leverage that transport, will enable creation of new RF –based public-safety and homeland-security systems. It’s impossible to predict what new systems or services will be created, but resilient transport is key.

Similarly, we seek comment on how access to broadband capability in general and specific broadband services in particular will ensure that broadband-based applications and support systems (over any broadband transport platform) are compatible among different public safety agencies.

Access to transport does NOT guarantee compatibility. That is a different effort, and one that should receive Federal involvement. The Federal government does not need to pick specific winners and losers, nor should it. It can, however, use its power to fund testing and evaluation to ensure that all solutions are objectively graded for real interoperability.